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THE RELATIONSHIP OF MEMORY, REASONING, AND SPEED OF PROCESSING ON FALLING AMONG OLDER ADULTS

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Abstract

Older adults are at higher risk of falling and of suffering greater devastating effects from such falls. The objective of this study was to longitudinally examine predictors for risk of falling such as cognitive composites (reasoning, memory, speed of processing) along with traditional predictors. Data on falls, cognition, objective functional tests, visual acuity, and demographics were collected on older adults at baseline ($\underline{N}$ = 698) and at a two-year annual follow-up ($\underline{n}$ = 550). By using hierarchical multiple regression, we found that older age, being an older Caucasian woman, poorer performance on Turn 360 at baseline, and having a better memory at baseline predicted higher reports of falling in the past two months at the two-year annual follow-up. These results confirm prior findings except for memory; however, better memory as a predictor of falls may indicate that there is a recall bias dependent on memory function.

Keywords

Falling; Memory; Speed of Processing; Executive Functioning

Falls are one of the most common causes of injuries in older adults resulting in hospital care and death (Cumming, Nevitt, & Cummings, 1997; Kreisfeld, 2000). Nearly one-third to one-half of elderly persons fall each year, of whom approximately 20% require medical attention afterward (Gillespie et al., 2003). One of the primary predictors of falling is a prior history of falls (Gerdhem, Ringsberg, Akersson, & Obrant, 2005). However, there are numerous other risk factors for falls in community-dwelling older adults including older age (Gerdhem, Ringsberg, Akersson, & Obrant, 2005; Moreland et al., 2003), neurological disease (Ashburn, Stack, Pickering, & Ward, 2001; Friedman, Munoz, West, Rubin, & Fried, 2002; Nevitt, Cummings, Kidd, & Black, 1989; Syrjälä, Luukinen, Pyhtinen, & Tolonen, 2004), visual impairment (Lord & Dayhew, 2001; Tromp et al., 2001), low blood pressure (Kario et al. 2001; Leipzig, Cummings, & Tinetti, 1999a; Leipzig, Cummings, & Tinetti, 1999b), dizziness

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(Stel et al., 2003), and functional limitations such as gait and balance disturbances (Tromp et al., 2001; Tromp, Smit, Deeg, Bouter,& Lips, 1998). Cognitive impairment types have also been shown to be predictive of falls and poorer gait (Van Schoor, Smit, Pluijm, Jonker, & Lips, 2002).

According to the Common Cause Hypothesis, with advancing age, neural degradation occurs within the nervous system equally affecting cognitive abilities as well as perceptual abilities important for keeping one's balance, seeing barriers within one's walking path, as well as other perceptual and motor skills necessary to avoid falling (Ball, Vance, Edwards, & Wadley, 2004). For that reason, it is essential to consider cognition as a predictor of falling in older adults. Overall cognitive impairment is predictive of falling in older adults (Lord & Clark, 1996); and, various specific cognitive domains have also been shown to predict falls. For example, declines in executive functioning (Rapport, Hanks, Millis, & Deshpande, 1998) and short-term memory (Kron, Loy, Sturm, Nikolaus, & Becker, 2003) predict falls while declines in overall cognitive functioning (Hauer et al., 2003) and attention predict postural control problems (Shumway-Cook & Woollacott, 2000). However, van Schoor et al. (2002) examined which cognitive domain (general cognitive functioning, nonverbal and abstract reasoning, information processing speed, and immediate memory) was most strongly related to falls among older persons. While all of these cognitive domains were significant predictors at the univariate level, only immediate memory was significant at the multivariate level. This finding indicates that the type of cognitive domain may have a unique effect on falls in older adults. However, van Schoor et al. used only one test of each of the cognitive domains; multiple measures in each domain would help to further examine the relationship between specific cognitive domains and falls. This approach is important because a fall risk assessment for community-dwelling older adults incorporating relevant cognitive domains could be used to identify those at greatest risk, and possibly target prevention efforts to these individuals.

The present study analyzed data from the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) trial. The aim of this study was to find the variables or combination of variables that best predicted future falls in a population-based sample of community-dwelling older adults. In particular, the effects of specific cognitive domains (speed of processing, memory, reasoning) were investigated to determine whether such abilities are more predictive of falling than general cognitive functioning. If specific cognitive domains are predictive of falling, cognitive training known to ameliorate functioning in that domain (Ball et al., 2002) could be used to mitigate fall risk. We examined the association between self-reported falls and measures of cognitive function, functional limitations, and other predictors.

METHOD

Sample

The recruitment goal of the ACTIVE trial was to enroll a diverse, representative sample of older adults who at baseline were cognitively-intact and living independently. Participants were recruited between March 1998 and October 1999 from 6 field sites nation-wide. Participants were recruited using a variety of strategies such as senior housing sites, medical clinic rosters, senior citizen and community center rosters, and state driver's license and identification card registries. Participants were assessed over the phone to determine whether they met minimum entry criteria. Further recruitment details are published elsewhere (Jobe et al., 2001).

Detailed exclusion criteria were used during telephone screening and baseline to determine eligibility of participants. Adults were excluded if: they were younger than 65 years of age at screening; had obvious cognitive deficits as indicated by a score of 22 or less on the Mini-Mental Status Exam (MMSE; Folstein, Folstein, & McHugh, 1975); reported a diagnosis of Alzheimer's disease or dementia; reported substantial functional decline; had medical conditions that could substantially interfere with their participation or predispose them to impending functional declines (e,g., undergoing chemotherapy or radiation therapy, stroke within the past 12 months); were unavailable during training and assessment periods; had severe vision loss (measured vision worse than 20/70 with best correction or self-reported difficulty in reading newsprint); had severe hearing loss; or, had severe communicative problems that would impede participation. In addition, because the larger study was a cognitive intervention clinical trial, participants were excluded if they had already received cognitive training.

Procedure

The original study design of the ACTIVE protocol consisted of randomizing participants to one of four conditions (reasoning, speed of processing, memory, or no contact control). Because the emphasis of this paper is on naturalistic factors predicting falls, only the participants in the no contact control group (N = 698 at baseline, n = 550 at a two-year annual follow-up) were included. Participants were assessed with a comprehensive battery by a trained interviewer at the research facility during baseline, approximately two months later, and then annually.

Instruments

Dependent Variable—Falls were defined as "accidentally losing your balance and falling on the ground or falling against something such as furniture." Participants were asked how many falls they had experienced in the last two months, similar to the Lifespace Questionnaire (Stalvey, Owsley, Sloane, & Ball, 1999). Additional information about results of the fall (injured, required medical attention) and if something (e.g., rug, stairs, curb, wet or icy surface) contributed to the fall were also ascertained. Falls were recorded retrospectively during the baseline and two-year annual follow-up periods and were used as the dependent variable.

Independent Variables—Cognition was determined by three different sets of cognitive tests. Memory functioning emphasized episodic verbal memory tasks and was assessed by the Hopkins Verbal Learning Test (Brandt, 1991), the Auditory Verbal Learning Test (Rey, 1941), and the Rivermead Behavioral Memory Test (Wilson, Cockburn, & Baddeley, 1985). Reasoning functioning emphasized tasks that required the identification of patterns in groups of numbers and letters and was assessed by a word series test (Gonda & Schaie, 1985), a letter series test (Thurstone & Thurstone, 1949), and a letter set test (Ekstrom, French, Harman, & Derman, 1976). Speed of processing emphasized identification and localization of targets at increasing speeds and complexities with 75% accuracy and was assessed by the Useful Field of View® test (Ball & Owsley, 1993). These cognitive tests were standardized by pooling the values at all time points using a statistical technique called Blom transformation (Blom, 1958); this produces more normally distributed scores. Values for the cognitive tests at each time point were standardized to the baseline mean and standard deviation (SD). If one or more cognitive tests for the composite value were missing, the remaining non-missing tests were averaged to generate the composite value. Higher scores indicate better cognitive functioning.

Demographics—Possible confounds known from the literature include: age, gender, race, and education. Prior studies have shown that age (Gerdhem, Ringsberg, Akersson, & Obrant, 2005), education (Tromp et al., 2001), race (Hanlon, Landerman, Fillenbaum, & Studenski, 2002; Stevens & Dellinger, 2002), and gender (Campbell, Spears, & Borrie, 1990; Vellas, Wayne, Garry, & Baumgartner, 1998) are related to falls. In fact, the interaction between age, gender, and race may provide additional insight into the vulnerability of falling in certain groups (Nabeshima, Hagihara, Hayashi, Nabeshima, & Okochi, 2007). Education level was measured by asking participants to indicate their highest level of education completed, ranging from 0 (did not go to school), 12 (grade 12/GED equivalence), to 20 (doctoral degree).

Education is a unique confounding variable because it is also associated with cognitive functioning (Schmand, Lindeboom, Hooijer, & Jonker, 1995).

Moderating Factors—Possible moderating factors include: visual acuity, depressive symptomatology, grip strength, and turn 360. Far visual acuity was assessed binocularly with a standard eye chart and expressed as log minimum angle of resolution. When applicable, visual measurement was taken with the participant's own corrective lenses. This procedure is typical of vision research and is valid for real-world functioning (Vance et al., 2007).

Depressive symptomatology was assessed by the Center for Epidemiological Studies – Depression-12 (Radloff, 1977). This measure has 12 items to which participants would indicate on a 4-point Likert-type scale how often they identify with a depressive symptom. Scores range from 0 to 36 with higher scores indicating more depressive symptomatology.

Grip strength (Ferrucci et al., 1995) was assessed by using a dynanometer with the dominant hand and is a measure of upper-body strength. Two readings were acquired; the average of these two readings was used as the grip strength score. Higher scores indicate stronger grip strength. Turn 360 (Steinhagen-Thiessen, & Borchelt, 1999) was measured by the number of steps required to turn completely around and is a measure of lower limb mobility. Two readings were acquired; the average of these two readings was used as the Turn 360 score. Fewer steps taken indicate better lower limb mobility.

Statistical Analysis

Listwise deletion was e mployed to ensure that complete data were available for the analyses. Data were recoded to within four SD of the mean. This recoding was particularly important for the number of falls variable, given that at baseline one participant reported falling a total of 45 times, and at the two-year annual follow-up another participant reported falling 40 times. Three participants at baseline and three participants at year two exceeded the number of falls by more than four SD and were recoded to eight falls. In addition, two participants were recoded on the CES-D from scores of 25 and 26 to within four standard deviations, resulting in a score of 24. Less than 1% of the data were recoded within four SD. Recoding was necessary to reduce the variance and skewness and helped with meeting the assumptions of the statistical analyses.

Of the 698 control participants, 550 had complete data for the analyses using baseline predictors and two-year annual follow-up data. Analyses of variance were conducted to determine differences between the 550 with complete data and the 148 with partial data. Correlations between the predictors and number of falls were conducted for the 550 participants. Interaction terms were created between age, gender, and minority status because the combination of these demographic factors may have particular influence on fall frequency.

The purpose of this study was determined what combination of variables, along with the specific cognitive composites, predicts falling in community-dwelling older adults over a two-year period. To do this, a hierarchical multiple regression was performed using the number of falls within a two-month period at the two-year annual follow-up as the dependent variable. The first level had age, gender (1 = men; 2 = female), race (0 = non-white; 1 = white), education, and all combinations of interaction terms between age, gender, and minority status. The second level had far visual acuity, grip strength, Turn 360, and depressive symptomatology. The last level had MMSE as a measure of global cognition along with the composites of speed of processing, memory, and reasoning.

RESULTS

Descriptive Data

Overall, by combining both columns in Table 1, it can be seen that the study population at baseline ($\underline{n}$ = 698) consisted of 514 (73.64%) women and 184 (26.36%) men. Participants were Caucasian ($\underline{n}$ = 503, 72.06%), African American ($\underline{n}$ = 187, 26.79%), or classified as other ($\underline{n}$ = 8, 1.15%). Mean age was 74.05 years (Range = 65 – 94; $\underline{SD}$ = 6.05 years). For the entire sample at baseline, 106 (15.2%) participants reported falling in the past two months; two years later 42 (7.64%) participants reported falling in the past two months. The average number of baseline falls was 0.27 (Range: 0 – 12; $\underline{SD}$ = 0.92 falls); at the two-year annual follow-up, the average number of falls was 0.17 (Range: 0 – 8; $\underline{SD}$ = 0.75 falls). From these descriptive characteristics, it is clear that nearly a third of older adults who fell reported that their fall(s) resulted in injury, even at the two-year annual follow-up. Between 10 and 20% reported that the fall(s) required medical attention. Furthermore, close to half of those who fell reported that something in their environment contributed to their fall(s).

Several participants ($\underline{n}$ = 147) did not return for their two-year annual follow-up; those missing data on study-related measures were excluded from the analysis. Table 1 shows the descriptive statistics for the variables of interest in this study separated according to those who had complete data (i.e., analyzed sample) for the analysis and those who had partial data (i.e., baseline only). A series of analyses revealed differences between these two groups. Compared to those with partial data, participants who had complete data reported having fewer falls in the past two months at baseline $\underline{\chi^2}(\underline{n} = 690) = 64.08$, $\underline{p} < .001$. Similarly, those who have complete data reported falling significantly fewer times in the past two months at baseline compared to those with partial data $\underline{F}(1, 688) = 23.73$, $\underline{p} < .001$. Those with complete data performed significantly better on the MMSE $\underline{F}(1, 696) = 4.62$, $\underline{p} < .05$, worse on the memory composites $\underline{F}(1, 696) = 10.57$, $\underline{p} < .001$, and better on Turn 360 $\underline{F}(1, 671) = 5.82$, $\underline{p} < .05$, compared to those with partial data.

Correlations

Table 2 provides Pearson's and Kendal Tau's correlations for the study variables. Number of falls at baseline was correlated with the number of falls at the two-year annual follow-up ($\underline{r}$ = .11; $\underline{p}$ < .01). Baseline depressive symptomatology was related to the number of falls at baseline ($\underline{r}$ = .14, $\underline{p}$ < .01) but not at the two-year annual follow-up. Otherwise, no bivariate correlations were observed between the number of falls and the variables of interest. However, several relationships were observed between the predictors; this suggests these predictors may have a relationship with falling once the variance between the predictors is controlled.

Hierarchical Multiple Regression

To predict which factors are important in predicting the number of falls reported during the past two months at the two-year annual follow-up, hierarchical multiple regression was used. All combination of interaction terms for age, gender, and minority status were included as unique predictors. In the first step, age, gender, minority status, age × gender, age × minority, gender × minority, and age × gender × minority, and years of education were included. In the second step, grip strength, Turn 360, far visual acuity, and depression were included. In the last step, the cognitive measures of MMSE, speed of processing composite, memory composite, and reasoning composite were added. Table 3 shows the last step of the hierarchical regression model. The model shows that increasing age, being an older Caucasian female, performing poorly on Turn 360, and having a better memory composite at baseline predicted higher reports of falling at the two-year annual follow-up.

This analysis was supported by another hierarchical multiple regression without the interaction terms. In this case, being female ($\beta = -.11$; $p < .05$), poor performance on Turn 360 ($\beta = -.11$; $p < .05$), and having better memory functioning ($\beta = .15$; $p < .05$) remained predictive of the number of falls within two months of the two-year annual follow-up. No other variables were significant.

This analysis was supported by yet another hierarchical multiple regression with baseline falls entered first while keeping the original interaction terms. In this case, number of falls at baseline ($\beta = -.13$; $p < .05$) was predictive of falls at the two-year annual follow-up. In addition, being older ($\beta = 1.04$; $p < .05$), being female ($\beta = 3.13$; $p < .05$), being older and female ($\beta = -3.06$; $p < .05$), poorer performance on Turn 360 ($\beta = -.11$; $p < .05$), and having better memory functioning ($\beta = .15$; $p < .05$) remained predictive of the number of falls within two months at the two-year annual follow-up. Meanwhile, minority status approached significance ($\beta = 5.92$; $p = .052$). No other variables were significant.

DISCUSSION

The purpose of this study was to determine what combination of variables, including three cognitive composites, were predictive of falling in a sample of community-dwelling older adults. We found that those participants who were older, female, Caucasian, performed poorer on a test of lower limb mobility, and had better memory functioning reported more falls at the two-year annual follow-up. Many of these findings correspond to previous research. It is not surprising that increased age is associated with more prevalence of falls. Several age-related changes such as declines in psychomotor ability, less stamina and coordination, and poorer vision may cumulatively account for this relationship (Akyol, 2007; Gerdhem et al., 2005; Guo et al., 2000; Voermans, Snijders, Schoon, & Bloem, 2007).

Being female was also found to be associated with fall risk. This finding corresponds to some of the literature (Campbell et al., 1990; Vellas et al., 1998), but not to other research that found men to be more at risk for falling (Weeks, 2007). However, it may be the interaction of aging and being female that contributes to this risk. Furthermore, because men have a lifespan that is typically shorter than that of women, those men who are in the study, because they have made it to a certain age, may be hardier in general and less prone to fall. And indeed, the average age of the men in the sample (N = 550) was 74.4 years old and 73.8 years old for the women. But another explanation for this finding is that since the sample is predominantly female, this study may be under powered to assess falls in men.

Being Caucasian was independently associated with fall risk. In a 3-year longitudinal study with 1,049 African Americans and 1,947 Caucasians, Hanlon et al. (2002) also found that Caucasians reported a higher rate of falling. The reason for this is not clear. Perhaps these two groups define falling for themselves differently. Likewise, these groups may place different emphasis on falling, such that Caucasians better remember such incidents. Faulkner et al. (2005) also found that Caucasian women had a higher rate of falling than African American women. They found that Caucasian women were more likely to fall outside versus indoors. Perhaps such environmental differences account for this finding.

Poor lower limb mobility as measured by Turn 360 was found to predict falls after two years. This finding corresponds to the literature (Di Fabio, Kuszewski, Jorgenson, & Kunz, 2004; Vassallo, Stockdale, Sharma, Briggs, & Allen, 2005). Intuitively, those adults who have difficulty maintaining balance will be more prone to falling.

Finding that better memory functioning was predictive of more falls is contradictory to the idea that cognitive decline contributes to poorer physical functioning. In fact, in a similar study, when van Schoor et al. (2002) examined the effects of immediate memory, nonverbal and abstract reasoning, and information processing speed on falls in older adults, they found that those who had better memory performance reported fewer falls. However, they measured falls prospectively by having participants complete a weekly falls calendar over three years. In our study, falls data were retrospective in the sense that participants were asked to recall the number of falls they had over the last two months. Thus, it is quite possible that those who had better memory functioning were able to recall such falls versus those who had poorer memory. From this interpretation, the value of prospective data collected during brief time intervals is obvious in examining cognitive predictors of falls in older adults. Yet, even in prospective studies, participants must still remember to document falling in a diary or other such data device. Therefore, this memory component may be a problem in both prospective and retrospective studies on falling. A more objective measure, such as wearing an actimeter that registers falls, may be more valid and reliable in gathering falls data in older adults with various memory abilities.

Another limitation of this study is that the magnitude of the findings, although statistically significant, was quite small. This could be because of the infrequency in which falls occur. Likewise, falling is a complex behavior with probably many causes. Therefore, it is difficult to find one single precursor to falling in older adults. For this reason, studies must continue to look at a variety and combination of possible causes of falling.

Despite these limitations, this study is one of the few to investigate the effects of cognitive domains on predicting falls. This approach is an improvement over other studies because composites were created based upon several validated instruments measuring the same domain. In addition, this study used a large sample size longitudinally. Also, this study used interaction terms to examine the combined influence of age, gender, and race.

In conclusion, age, gender, age-by-gender, and baseline measures of lower limb mobility, and memory were related to falls two years later. Because of our dependence on participants' reports of falls in the previous two months, better memory was found to be related to an increased risk of falls. This finding may be useful in redesigning future studies to incorporate a collection of data at multiple brief intervals and in interpreting findings from other studies that use a similar design to ours. Regardless, because the ACTIVE study primarily examined the effects of three cognitive training paradigms (speed of processing training, memory training, and reasoning training) (Ball et al., 2002), it will be interesting to see whether such training, especially memory training, will show to increase or decreases the number of self-reported falls in older adults.

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Table 1

Characteristics of ACTIVE Control Population.

Characteristic	Baseline Only (n = 148)	Analyzed Sample (n = 550)
Demographics		
Age, mean (range)	74.51 (65 – 93)	73.92 (65 – 94)
Female, %	85.00%	74.73%
Caucasian American, %	69.59%	72.73%
Years of Education, mean (range)	13.41 (8 – 20)	13.37 (6 – 20)
Baseline – Fallen in the past two months, frequency, % ‡	52 (37.51%) n = 140	54 (9.82%)
Number of falls in past two months, mean (range) ‡	1.71 (1 – 12)	1.78 (1 – 8)
Fall resulted in injury, frequency, %	22 (42.31%)	19 (35.19%)
Fall required medical attention, frequency, %	14 (26.92%)	11 (20.37%)
Something contributed to fall, frequency, %	21 (40.38%)	23 (42.59%)
Year 2 – Fallen in the past two months, frequency, %	NA	42 (7.64%)
Number of falls in past two months, mean (range)		1.88 (1 – 8)
Fall resulted in injury, frequency, %		13 (30.95%)
Fall required medical attention, frequency, %		5 (11.90%)
Something contributed to fall, frequency, %		24 (57.14%)
Cognition		
MMSE, mean (range)*	26.96 (23 – 30)	27.36 (23 – 30)
Speed of Processing Composite, mean (range)	0.14 (−6.09 – 4.05)	0.10 (−7.55 – 4.05)
Memory Composite, mean (range)	−0.71 (−7.18 – 6.64)	0.05 (−8.21 – 7.41)
Reasoning Composite, mean (range)	−0.55 (−6.67 – 7.20) n = 143	−0.07 (−6.51 – 8.99)
Far Visual Acuity (logMAR) (range)	74.18 (41.30 – 90.00)	72.88 (31.80 – 90.00)
Depression, mean (range)**	5.11 (0 – 22) n = 141	5.05 (0 – 24)
Grip Strength, mean (range)	22.11 (8 – 47) n = 46	24.44 (4 – 57)
Turn 360, mean (range)	7.24 (1.5 –14) n = 123	6.77 (1 – 20)

Note. Significant difference detected between participants for whom complete data were available and those who were missing data,

‡ $p<.01$,

† $p<.05$.

* Potential range of test = 0 – 30.

** Potential range of test = 0 – 36.

Table 2

Correlation between Predictors and Number of Falls at Annual 2 (N = 550)

N = 550	1 (c)	2 (c)	3 (c)	4 (o)	5 (o)	6 (c)	7 (c)	8 (o)	9 (c)	10 (c)	11 (c)	12 (c)	13 (c)	14 (c)	15 (c)	16 (c)	17 (c)
1. Number of Falls – Baseline	1.00																
2. Number of Falls – Year 2	.11‡	1.00															
3. Age	.03	.00	1.00														
4. Gender	−.03	−.01	−.09	1.00													
5. Race	.05	.03	.08	−.12‡	1.00												
6. Age × Gender	.01	.06	.26‡	.63‡	−.09†	1.00											
7. Age × Race	.05	.02	.21‡	−.10‡	.99‡	−.06	1.00										
8. Gender × Race	−.08	−.06	.04	.35‡	.81‡	.25‡	.52‡	1.00									
9. Age × Gender × Race	.04	.06	.17‡	.29‡	.89‡	.33‡	.89‡	.82‡	1.00								
10. Years of Education	.01	−.03	−.07	−.20‡	.89‡	−.24‡	.10*	−.04	−.02	1.00							
11. Grip Strength	−.03	−.05	−.08†	.00	−.12‡	−.03	−.13‡	−.11‡	−.14‡	.00	1.00						
12. Turn 360	.02	.06	.04	−.02	.09†	.02	.09†	.04	.09†	−.03	−.29‡	1.00					
13. Depressive Symptomatology	.14**	.05	.09†	.10‡	−.05	.16‡	−.03	.012	.03	−.25‡	−.01	.03	1.00				
14. Far Visual Acuity	.01	.04	−.35‡	−.05	−.10†	−.16‡	−.14‡	−.09‡	−.15‡	.04	.01	−.05	−.09†	1.00			
15. MMSE	−.02	.03	−.15‡	−.05	.19‡	−.11‡	.16‡	.12‡	.13‡	.27‡	−.02	.00	−.24‡	.15‡	1.00		
16. SOP	.02	−.06	.44‡	.02	−.16‡	.16‡	−.09†	−.09‡	−.07	−.20‡	−.03	.12‡	.18‡	−.25‡	−.35‡	1.00	
17. Memory	−.03	−.05	−.39‡	.13‡	.18‡	.05	.12‡	.18‡	.18‡	.29‡	.05	−.08	−.27‡	.13‡	.50‡	−.44‡	1.00
18. Reasoning	.00	.00	−.32‡	−.07	.31‡	−.17‡	.26‡	.18‡	.21‡	.42‡	.01	−.09†	−.31‡	.11‡	.48‡	−.53‡	.57‡

Note. C = continuous, o = ordinal.

‡ p<.01,

† p<.05†‡

Table 3

Hierarchical Multiple Regression Predicting Number of Falls in Last 2 Months at Annual 2 (N = 550)

Variable	B	SE B	β
Age	.06	.03	1.05†
Gender	2.22	1.05	3.18†
Minority Status	4.27	2.14	6.10†
Age × Gender	−.03	.01	−3.13†
Age × Minority Status	−.05	.03	−5.61
Gender × Minority Status	−2.12	1.15	−5.83
Age × Gender × Minority Status	.03	.02	5.26
Years of Education	−.01	.01	−.05
Grip Strength	.00	.00	.00
Turn 360	−.02	.001	−.11†
Depressive Symptomatology	.00	.00	−.07
Far Visual Acuity	.00	.00	−.03
MMSE	−.01	.01	−.06
Speed of Processing Composite	.00	.01	.03
Memory Composite	.02	.01	.15†
Reasoning Composite	.00	.01	.02

Note. R^2 = .035 for Step 1; ΔR^2 = .021 for Step 2; ΔR^2 = .013 for Step 3

†ps < .05.